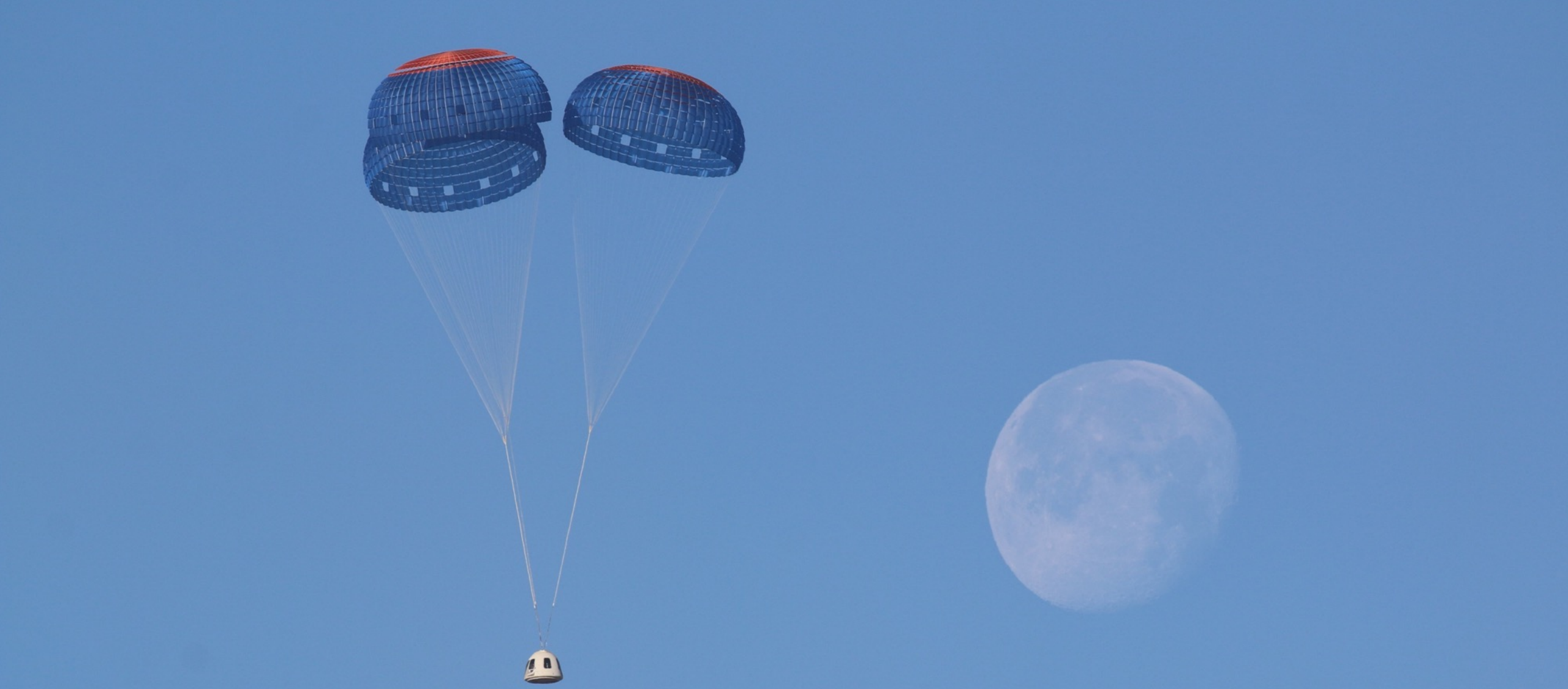


Addition of Commercial Suborbital Platforms to ROSES-22

D.3 Astrophysics Research and Analysis Program (APRA)
B.9 Heliophysics – Low Cost Access to Space (H-LCAS)

Lucas Moxey, NASA Flight Opportunities / SMD Headquarters

Vision

Build upon the success of NASA's sounding rocket and balloon programs by making commercial suborbital platforms available to SMD-sponsored investigators alongside NASA-provided platforms.

EXPLORE SPACE TECH

THROUGH SUBORBITAL FLIGHT

The Flight Opportunities program rapidly demonstrates promising technologies for space exploration, discovery, and the expansion of space commerce through suborbital testing with industry flight providers.

Photo Credit: Blue Origin

NASA COMMERCIAL IDIQ VEHICLE TYPES

Rocket-Powered Vehicles

Typically recoverable and reusable

Parabolic Flights

Offers brief periods of microgravity

High-Altitude Balloons

Provides long-duration periods of data collection

Vertical Takeoff Vertical Landing (VTVL) Vehicles

Simulates lunar and planetary landing conditions

ADVANCING A WIDE RANGE OF TECHNOLOGIES

Sensors and Instruments

Mechanical Systems and Manufacturing

Human Health and Habitation

Thermal Management

INNOVATORS FROM

NASA
Universities
Small Businesses
Non-Profit Research Institutes

Propulsion, Power, Energy Storage

Landing and Navigation

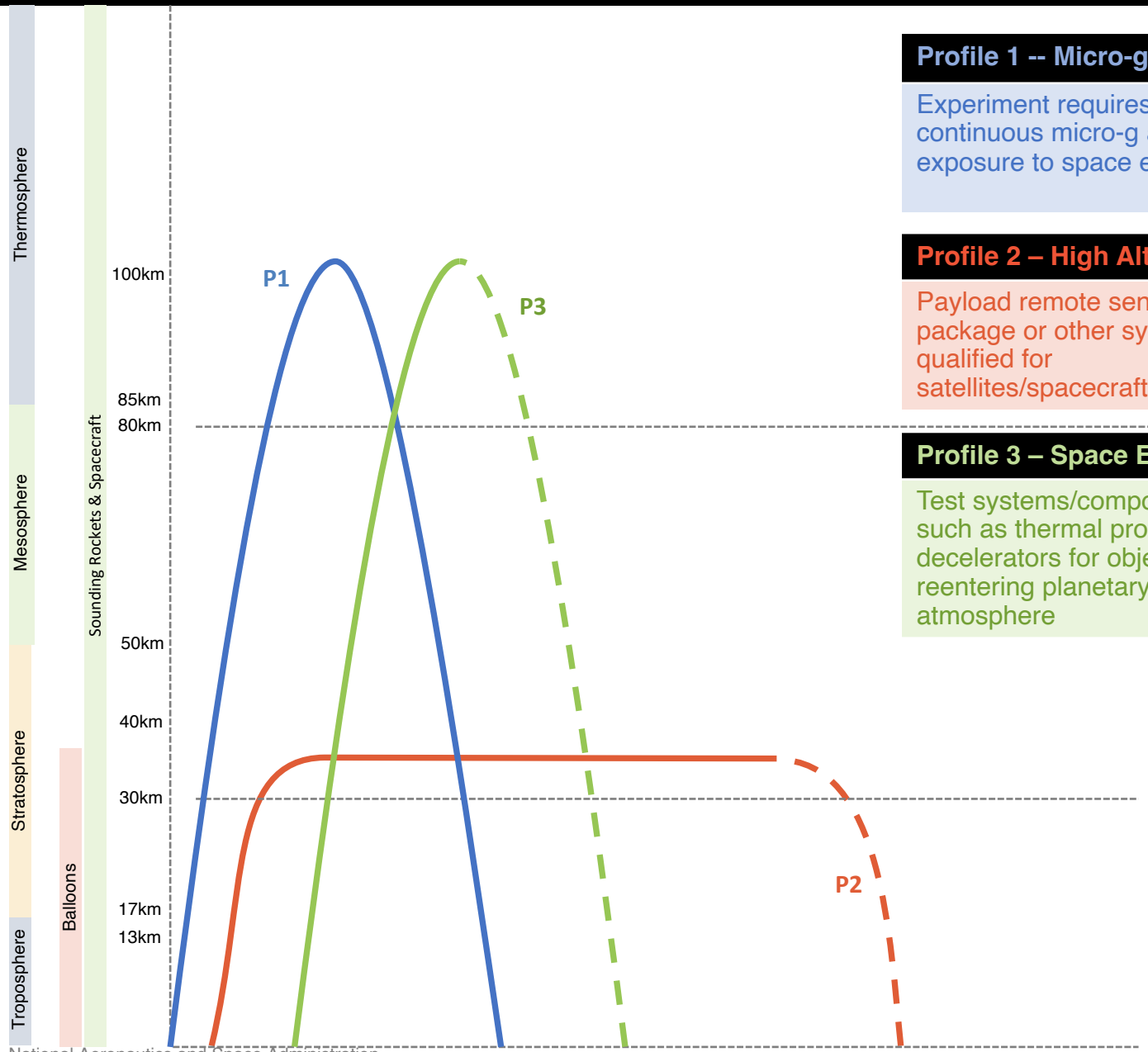
Robotics

Surface Exploration

AVAILABLE COMMERCIAL IDIQ SUBORBITAL PLATFORMS IN ROSES-22

APRA & H-LCAS

ROSES-22 (APRA & H-LCAS) & NASA COMMERCIAL IDIQ FLIGHT PROVIDERS



Profile 1 -- Micro-g and/or Space Environment		
Experiment requires >2 min of continuous micro-g and/or exposure to space environment	80km minimum +/- 0.005g for > 2 min Near-vacuum/Low T – optional	Typically, a reusable sounding rocket or suborbital launch vehicle / spaceplane

Profile 2 – High Altitude Exposure		
Payload remote sensing package or other system being qualified for satellites/spacecraft	30km for 1 hour minimum Followed by descent to 0 AGL Descent may test parachutes/ atmospheric descent systems	Untethered balloon with parachute descent

Profile 3 – Space Environment w/ Free-Fall Descent		
Test systems/components such as thermal protection or decelerators for objects reentering planetary atmosphere	80km min, typically ≥ 100km Payload ejection at apogee Followed by rapid free-fall descent of payload to 0 km AGL	Typically, a reusable sounding rocket with payload ejected at apogee

NASA-Contracted Providers (IDIQ)

BLUE ORIGIN

Virgin GALACTIC

UP Aerospace

WORLD VIEW®

AEROSTAR

New Shepard

This fully reusable space vehicle offers fast turnaround times from launch to payload recovery and the next flight.

Target duration: 15 minutes

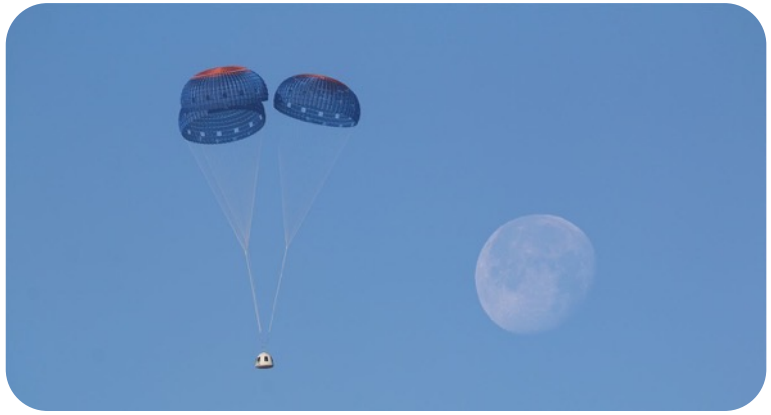
Target altitude: 100+ km

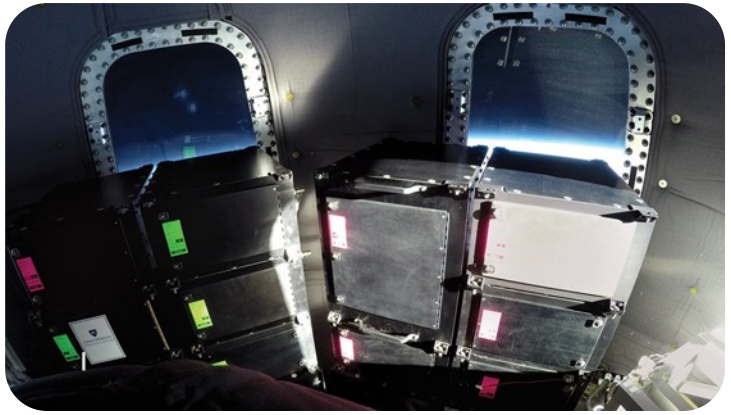
Target microgravity duration:
3 minutes

Payload capacity:

- 11.3 kg (single locker)
- 22.7 kg (double locker)
- custom solutions of up to 100.5 kg)

Payload mounting: Internal or external





Top: New Shepard is prepared for flight on the Blue Origin launch platform in West Texas. Credit: Blue Origin

Bottom left: New Shepard's crew capsule (with payloads inside) separates from the propulsion module and is recovered by parachute. Credit: Blue Origin

Bottom right: Payload lockers are located inside the New Shepard crew capsule. Credit: Blue Origin

VSS Unity

This piloted suborbital space plane features high payload-carrying capacity and fast payload recovery options.

Target duration: ~1 hour

Target altitude: 80+ km

Target microgravity duration: 2-3 minutes

Payload capacity:

- 22.7 kg (single locker)
- 45.4 kg (double locker)
- Other combinations & custom solutions may be available for larger payloads up to 450 kg

Payload mounting: Internal

Top left: Virgin Galactic's space plane as seen from inside the cockpit. Credit: Virgin Galactic

Top right: A payload is loaded into the cargo bay of VSS Unity. Credit: Virgin Galactic

Bottom: The space plane comes in for a smooth landing on the runway at Mojave Air and Space Port. Credit: Virgin Galactic

SpaceLoft XL

This rocket is suitable for both scientific and technology payload testing and includes a payload ejection option (as a non-standard service) for experiment recovery.

Target duration: ~13 minutes

Target altitude: 115 km

Target microgravity duration: ~4 minutes

Payload capacity: Nominal 36 kg

Payload mounting: Internal/external (Payload Transportation System modules are enclosed in aluminum but feature windows that provide direct access to the space environment)

Top left: SpaceLoft XL is shown here prepared for launch. Credit: UP Aerospace

Top right: A payload ejection option enables payload recovery after flight. Credit: U.S. Army

Bottom: A payload canister is prepared for integration onto the SpaceLoft rocket. Credit: UP Aerospace

Zero-Pressure Balloon System

Several classes of balloons are available for long-duration and navigational missions, stratospheric missions for scientific, engineering, and communication advances, gathering meteorological data, and more.

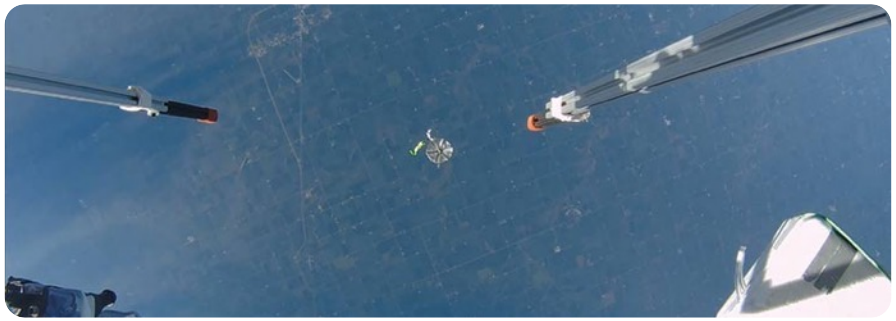
Target duration: 1–8 hours

Target altitude: 30+ km (33 km for payloads less than 5 kg)

Target microgravity duration: N/A

Payload capacity: Nominal 45 kg (heavier payloads can be accommodated as a non-standard service)

Payload mounting: Internal/external (the payload envelope is open to the external environment)



Top: A Zero-Pressure balloon from Aerostar is prepared for flight in Baltic, South Dakota. Credit: NASA

Left: A payload is released from a balloon flight with parachute assistance. Credit: NASA

Stratollite

This navigable system with station-keeping capabilities is suitable for payloads requiring data acquisition over long durations.

Target duration: Up to weeks

Target altitude: 15-23 km (to enable long-duration or long-dwell missions)

Target microgravity duration: N/A

Payload capacity: Nominal 50 kg (custom options available for larger payloads)

Payload mounting: External

Z-Class

This fixed-altitude balloon system is designed for payloads requiring short-duration data acquisition.

Target duration: 2+ hours

Target altitude: 30+ km

Target microgravity duration: N/A

Payload capacity: < 1 to 1,000 kg

Payload mounting: External

Top: A World View balloon is shown prepared for flight outside the company's launch facility in Tucson, Arizona. Credit: World View Enterprises

Bottom: Flights can be scheduled for different times of day and over different types of terrain, depending on payload testing requirements. Credit: Earth Science Systems

Important Guidelines for APRA (D.3) and H-LCAS (B.9) Solicitations

1. Proposals must follow the suborbital flight guidelines specified in Section VIII(c) ROSES-2022 Summary of Solicitation
2. Mandatory brief NOI-stage Payload Requirements Document (PRD) (available via NSPIRES)
   - Provides basic information about the proposed payload needs (e.g.: vehicle type, dimensions, mass, launch location, flight date, min/max altitudes, etc.)
   - Used by NASA to conduct preliminary assessments of compatible suborbital platforms
   - PRD information will not be used as part of proposal evaluation process
3. Mandatory Proposal-stage Payload Requirements Document (PRD) (Available via NSPIRES)
   - Provides more detailed information about the payload needs
   - Used by NASA to match payload requirements with suitable suborbital platforms
4. No quotes or cost estimates related to flight services should be included in the proposal
5. If selected, NASA Campaign Manager will serve as liaison between PI and commercial flight provider

Sample NOI PRD

ROSES-2022, D.3 Astrophysics Research and Analysis Program
(APRA)
NOI-Stage Payload Requirements Document

This form is required for all ROSES-APRA (D.3) rocket-powered vehicles (sounding rocket) and high-altitude balloon suborbital investigations for NOI submission.

PI Name / Organization
Proposal title

Type of suborbital vehicle (high-altitude balloon or rocket-powered vehicle)
Approx. dimensions (width, height, length) [m]
Approx. mass [kg]; Approx. power [W] (if power will be supplied by the vehicle)
Launch location requirements
Flight date requirements

Flight Opportunities Community of Practice Webinar

Designed to distill and share most important lessons learned by suborbital researchers.

First Wednesday of each month 10 am PT

Flight Opportunities Newsletter

www.nasa.gov/flightopportunities

NASA FLIGHT OPPORTUNITIES PROGRAM

https://www.nasa.gov/directorates/spacetech/flightopportunities

Questions concerning FOP-contracted commercial suborbital launch vehicles & ROSES-22:

Lucas Moxey (lucas.e.moxey@nasa.gov)